Advances in small pixel TES-based X-ray microcalorimeter arrays for solar physics and astrophysics

S.R.Bandler, J.S. Adams, C.N. Bailey, S.E. Busch, J.A. Chervenak, M.E. Eckart, A. E. Ewin,
F.M. Finkbeiner, R.L. Kelley, D.P. Kelly, C.A. Kilbourne, J.-P. Porst, F.S. Porter,
J.E. Sadleir, S.J. Smith, E.J. Wassell

We are developing small-pixel transition-edge-sensor (TES) for solar physics and astrophysics applications. These large format close-packed arrays are fabricated on solid silicon substrates and are designed to accommodate count-rates of up to a few hundred counts/pixel/second at a FWHM energy resolution ~ 2 eV at 6 keV. We have fabricated versions that utilize narrow-line planar and stripline wiring. We present measurements of the performance and uniformity of kilo-pixel arrays, incorporating TESs with single 65-micron absorbers on a 75-micron pitch, as well as versions with more than one absorber attached to the TES, 4-absorber and 9-absorber "Hydras".

We have also fabricated a version of this detector optimized for lower energies and lower count-rate applications. These devices have a lower superconducting transition temperature and are operated just above the 40mK heat sink temperature. This results in a lower heat capacity and low thermal conductance to the heat sink. With individual single pixels of this type we have achieved a FWHM energy resolution of 0.9 eV with 1.5 keV Al K x-rays, to our knowledge the first x-ray microcalorimeter with sub-eV energy resolution. The 4-absorber and 9-absorber versions of this type achieved FWHM energy resolutions of 1.4 eV and 2.1 eV at 1.5 keV respectively. We will discuss the application of these devices for new astrophysics mission concepts.